circuit board 4 side is heated by a heater 9a of the stage 9 or the like, the temperature of the bonding tool 8 can further be reduced.

(Seventeenth Embodiment)

A method and apparatus for mounting an electronic component of, for example, an IC chip on a circuit board and an electronic component unit or module of, for example, a semiconductor device in which the IC chip is mounted on the board by the mounting method, according to a seventeenth embodiment of the present invention will be described next.

This seventeenth embodiment is made more preferable than the sixteenth embodiment by setting the ratio of mixture of the inorganic filler 6f to be mixed with the thermosetting resin sheet 6 to 5 to 90 wt% of the insulative thermosetting resin of, for example, the insulative thermosetting epoxy resin 306m. When the ratio is lower than 5 wt%, the mixture of the inorganic filler 6f is meaningless. When the ratio exceeds 90 wt%, the adhesive strength is extremely reduced, and it is difficult to form a sheet, leading to a disadvantage. As an example, from the point of view of maintaining high reliability, it is preferable to set the ratio to 20 to 40 wt% in the case of a resin board and to 40 to 70 wt% in the case of a ceramic board. In the case of a glass epoxy board, the

coefficient of linear expansion of the sheet encapsulant can be considerably reduced at a ratio of about 20 wt%, producing an effect on the resin board. The ratio is set about half the percentage by weight in terms of volume percentage or in the proportions of 1 part epoxy resin to 2 parts silica in terms of specific gravity. In the normal case, the ratio of mixture of this inorganic filler 6f is determined by the manufacturing conditions in forming the thermosetting resin 306m into a sheet, by the elastic modulus of the board 4 and finally by the result of a reliability test.

By mixing the inorganic filler 6f at the aforementioned ratio of mixture with the thermosetting resin sheet 6, the elastic modulus of the thermosetting resin 306m of the thermosetting resin sheet 6 can be increased, and the reliability of bonding of the IC chip 1 to the board 4 can be improved by reducing the coefficient of thermal expansion. Moreover, the ratio of mixture of the inorganic filler 6f can be determined so that the material constant of the thermosetting resin 306m, i.e., the elastic modulus and the coefficient of linear expansion are optimized for the material of the board 4. It is to be noted that the coefficient of linear expansion tends to be reduced although the elastic modulus is increased as the ratio of mixture of the inorganic filler 6f is increased.

The sixteenth embodiment and the seventeenth embodiment have the advantage that the employed thermosetting resin sheet 6, which is not liquid but solid, is easy to handle and is able to be formed of polymer since no liquid component exists, allowing the objective one with a high glass transition point to be easily formed.

With reference to Fig. 38A through Fig. 38G, Fig. 39A through Fig. 39C and Fig. 43 and Fig. 44 described later, the formation of the thermosetting resin sheet 6 or the thermosetting adhesive 306b that is one example of the insulating resin layer on the circuit board 4 side has been described. However, without being limited to this, the sheet or adhesive may be formed on the IC chip 1 side and thereafter bonded to the board 4 as shown in Fig. 51A or Fig. 51B. In the case of, in particular, the thermosetting resin sheet 6, it is acceptable to stick the thermosetting resin sheet 6 to the IC chip 1 along the configuration of the bumps 3 by pressing the IC chip 1 held by a holding member 200 such as a suction nozzle against an elastic body 117 such as rubber on a stage 201 together with a separator 6a removably arranged on the circuit board side of the thermosetting resin sheet 6.

(Eighteenth Embodiment)

A method and apparatus for mounting an electronic component of, for example, an IC chip on a circuit board